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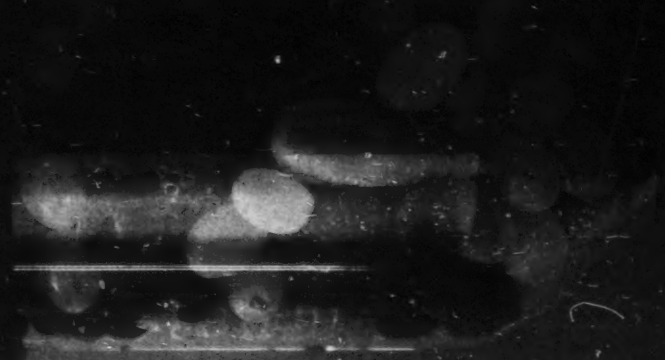
In this issue:
ENGINEERED FOODS

Food in the Year 2000



Some people think food will look like this someday. They're wrong.

What we eat in the future may not change that much. The same may not be said for the industry that manufactures foods and beverages. Survival in the food industry will not be easy. For the survivors, however, the next 15 years could be a "golden age".

See our special survey article on the future of the food industry, beginning on page 90.

Also in this issue:

IFT Pre-Show Report
Fiber-Enriched Foods
Creative World of Food Patents

Chilton's Food Engineering

ABOUT THE COVER

What does the future hold for the food industry? While it's risky to forecast, we've gathered views from throughout the industry and added them to our own conclusions.

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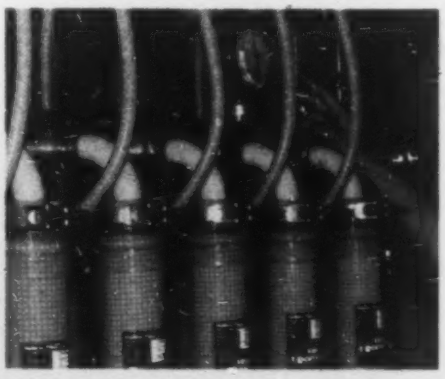

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Special focus is given to Quality Control equipment in this month's new product section.

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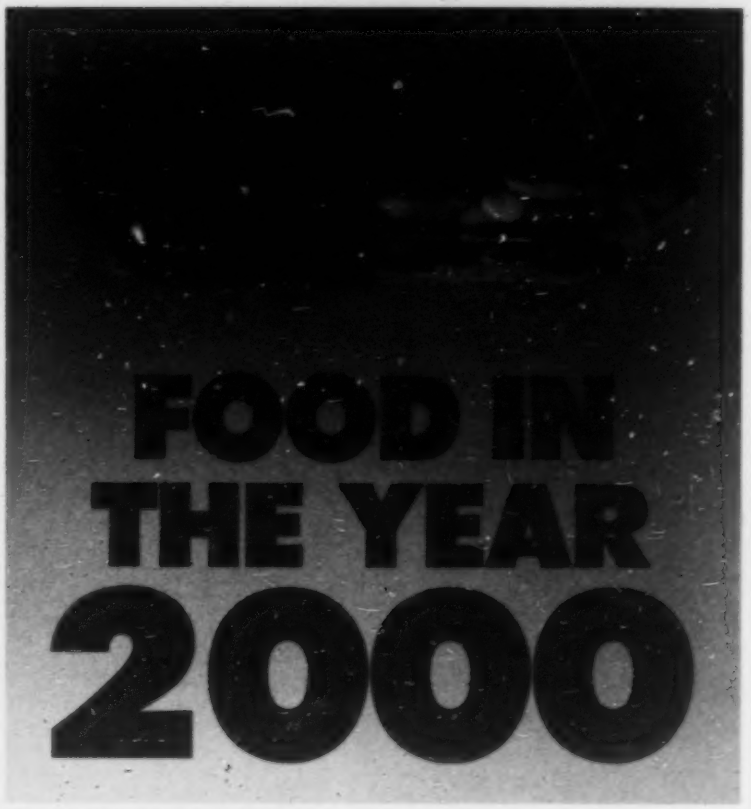


Looking into the future is risky business. But unless we plan ahead we may not be ready for what promises to be an even more competitive business by 2000.

OTHER VIEWS...
We don't have all the answers to the future. That's why we asked a number of experts to give us their thoughts on the food industry in the year 2000. Their comments help us further focus on a new world just fifteen years away. These other viewpoints of the year 2000 begin on page 102.

If you think the food industry is competitive today, wait 15 years. By the year 2000 we will truly have a food fight. On the other hand, it's a future worth fighting for. Industry profits will be up, the market affluent, technology diverse and creative.

The next fifteen years will remold the structure of the food and beverage industries. By the year 2000 there will be two kinds of food companies in the United States. One will be a giant, a conglomerate of many food companies with plenty of marketing muscle and distribution power. There could be just a dozen or so of these mega-giants.

The other kind of firm will be far smaller. It may have but one or two products. It will market these products creatively—through direct mail, consumer parties, video catalogs and devices we cannot today envision. Both its products and its manufacturing and marketing techniques will be outside what we call the mainstream today. In fact, they may do very little manufacturing at all. There could be thousands of these firms, many of them driven by entrepreneurs. Some of these companies will be built around new ideas in technology such as irradiation or enzymology.

Both corporate structures will market to an America whose values will have changed but whose basic diet could be remarkably like today's. You may have futuristic cars, you might do a lot of your work at a computer, you may live in geodesic domes, but you will still be eating fruits, vegetables, dairy products, and meat. What will change, and change even more dramatically than to date, is the packaging and processing of these products.

Food companies will seek an increasing amount of value-added preparation. As Dr. Dee Graham, director of technology development at Del Monte says: "The food industry has moved from selling the commodity, to selling the partially formulated product, to selling the wholly formulated product. As an example, first came flour, then cake mix, and then ready-to-eat cakes."

The food consumer in the year 2000 will be impatient with weekday food preparation and seek a high degree of convenience with no stinting on quality. The same consumer, at leisure, will enjoy weekend cooking only when it is fun or exotic.

Dr. Graham's view represents just one of many industry perspectives used to prepare this article on the future of food and the food industry. We went seeking thoughts on the future and we found plenty. One thing is obvious from our search. Those food conglomerates we talked about are already preparing for the future. As you read this article they are accumulating population projections and demographic trends. They are getting ready for the year 2000. So should we all. Fifteen years may sound like a long time but if you want to be a force in the market of the future, you need to develop strategies today.

WILLIAM H. LEMAIRE
Editorial Director

"What the big boys eat"

The baby-boomers take over and make their mark on America

When *Wheaties*, fueled by one of the most successful slogans in food promotion history ("the breakfast of champions"), suddenly became "what the big boys eat", you knew the baby-boom generation had arrived. Candy commercials are not aimed at just little kids anymore. Television commercials show truck drivers, waitresses, and office workers talking about how a candy snack satisfies their hunger till the

U.S. Census Bureau projections show that the population of the western U.S. will rise by 45 percent between 1980 and 2000. Meanwhile, growth in the midwest will stay pretty much on an even keel, while the northeast declines substantially.

next meal. Even toothpaste commercials are aimed not at that dreaded childhood affliction of cavities, but at romance stifling plaque.

"Boomers", those people born between the end of World War II and 1962, are just beginning to reshape America. There are some 74 million of them; they are affluent; they are materials-oriented; they have high expectations. Some people say they are spoiled. On the other hand, their demand for quality, convenience, health, and luxury is what could propel the food industry into a "golden age" of profitability and power.

Lean Cuisine, Stouffer's low-calorie frozen food entree, is the classic baby-boomer food. The quality is high, the portion ample, but not too filling, and it's convenient--three minutes in the microwave. The fact that it is also expensive didn't keep Stouffer's from ringing up $300 million in sales in 1983 from the product.

Boomers are not anti-children but they'll have fewer of them. And while U.S. family size may decline somewhat, these families will be wealthier than ever. Families with incomes of at least $30,000 should increase 62 per cent between 1980 and 1995. Families earning $50,000 will grow even faster, up 137 percent according to some projections. By 1995, one family in five will earn at least $50,000 annually, up from just one in ten in 1980.

The year 2000 will, as *FORTUNE* magazine says, "mark a millenium for marketers, with the boomers in their prime spending years of 40-54."

While this "land-of-plenty" scenario may sound like the marketing equivalent of shooting fish-in-a-barrel, it won't be. As the baby-boom generation marches through life, both as consumers and workers, its movement will be like a large wave with some sectors of the market cresting, others sagging. Riding the whims of this market will be the key to financial success. In other words, the consumer of 30 has a different purchasing agenda than at age 60. Keeping on top of these ebbs and flows in demand and desire, will make sociologists of many marketing men and women. For example, in just ten years from now there will be five million more children in America, but nine million fewer teenagers. At the same time, the number of Americans aged 31 to 56 will soar by over 20 million.

The graying of America

What happens when the baby-boomers face mortality?

Perhaps the foremost point to make in planning for the food industry in the year 2000 will be the age of the consumer. In fifteen years, 30 percent of the population will between 35 and 54 years. In that same time frame, those 55 years and over will be about 22 percent of the population. In other words, over half the U.S. population will either be facing 40 or 60, two of the most significant aging dates in our personal evolution.

The baby-boomers, you might say, will be

(Continued on next page)

facing their own mortality in the year 2000 and that has a way of changing the way people view life. It will also affect the way they eat.

"The 90-year-old man of the future will have the physical vigor of a 50-year-old man of today," says gerontologist Roy L. Walford in *The Futurist* magazine. Baby-boomers, already an active group of joggers, swimmers, etc., will seek ways to lengthen their life. This need for health and well-being led Campbell's CEO Gordon McGovern to redirect Campbell's from a conservative canning company to a youth-oriented, "fitness company".

But the boomers are getting older. They have grown accustomed to a society that finds solutions to problems. They are not fatalists. They will want a way to live longer. And, in fact, some gerontologists estimate that by the year 2000 there could be over 100,000 people in the country over the age of 100. One of the philosophies that may appeal to some of them is called "undernutrition".

After 30 years of research on aging, work at the University of California Medical Center in Los Angeles suggests that one key to living longer is eating less. The idea revolves around a spartan, low-calorie diet rich in vitamins and minerals--undernutrition without malnutrition you might call it.

Gerontologist Walford, quoted earlier, who heads the medical center program, eats 2,100 calories a day, fasting two consecutive days a week. While that may not sound like a trend that would sweep the country today, consider these two factors. Already we see an age of abstinence emerging with low-alcohol, low-calorie, low or no-caffeine. Combine that with a large population, accustomed to taking care of itself, and facing mortality square in the face. "Undernutrition" or any number of other dietary philosophies will have appeal in 2000.

As this population moves into the 21st Century and truly becomes elderly, another row of hurdles faces the food processor. Because, with old age, comes a loss in the ability to smell, to distinguish certain foods. A recent study at the University of Pennsylvania confirmed that the sense of smell diminshes with age. "Given these findings," the report says, "it is not surprising eldery persons complain their food lacks flavor." The study not only asserts that the ability to smell and distinguish odors drops off with age but also that women have a more acute sense of smell than men at any stage in life. These, again, are simple facts that the food developer of the future must consider.

The elderly population is expected to continue expanding into the year 2000...and beyond, as the forefront of the baby boomers reach 65 in 2010.

America's schizophrenic diet

Food brings out the two sides of our nutritional soul

The most dominant theme of the American diet in 1985 is light-and-low. America has become interesting for what it is *not* eating. Chicken and seafood consumption are on the rise. Pork and beef sales are less successful. Sugar consumption, per person, has plummeted to 67.5 pounds in 1984 from 100 in 1980. Bottled water usage per person in the U.S. has shot up to 3 gallons; diet sodas are now at 8.3 gallons per capita; alcohol, on the other hand, is down to 2 gallons. A recent article in *FORTUNE* magazine called this phenomenon "America's New Abstinence".

But marketing in America is a mine field. Trends, while important, have counter-trends running parallel. This is nowhere more evident than in the food industry. The dairy industry, responding to the public's concern over cholesterol, has come up with an array of lower-fat milks, yogurts, and other products. At the same, advertisements touting "cheese, glorious cheese" have kept high-fat cheese sales skyrocketing. Cheese is as much a Yuppie essential as white wine.

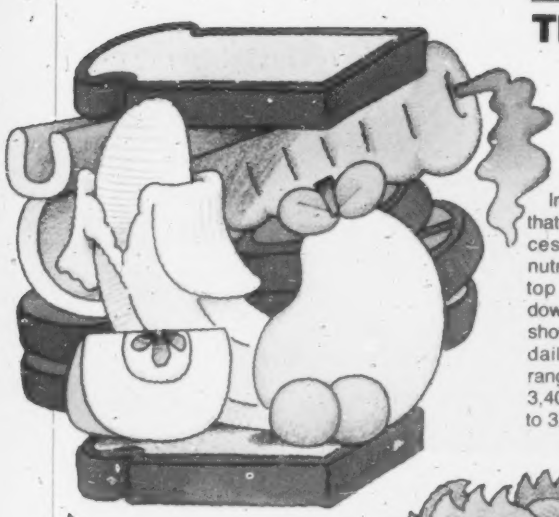
Low-calorie, low-alcohol beers maintain a solid pace in sales right along with heavier,

(Continued on next page)

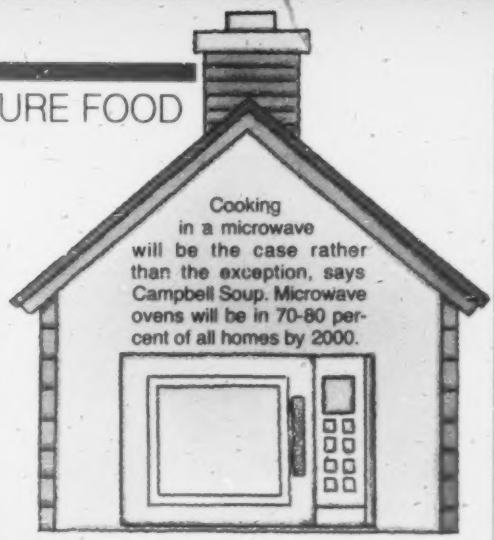
ELDERLY POPULATION: 1980-2040

	65 YEARS AND OLDER		75 YEARS AND OLDER		85 YEARS AND OLDER	
	Number (in millions)	% Increase in Preceding Decade	Number (in millions)	% Increase in Preceding Decade	Number (in millions)	% Increase in Preceding Decade
1980	25.7	28%	10.1	32%	2.3	59%
1990	31.8	24	13.7	37	3.5	52
2000	35.0	10	17.3	26	5.1	48
2010	39.3	12	19.0	9	6.8	33
2020	51.4	31	21.6	14	7.3	8
2030	64.3	25	29.9	38	8.8	20
2040	66.6	4	37.5	25	12.9	47

SOURCES: BUREAU OF THE CENSUS AND AMERICAN DEMOGRAPHICS MAGAZINE

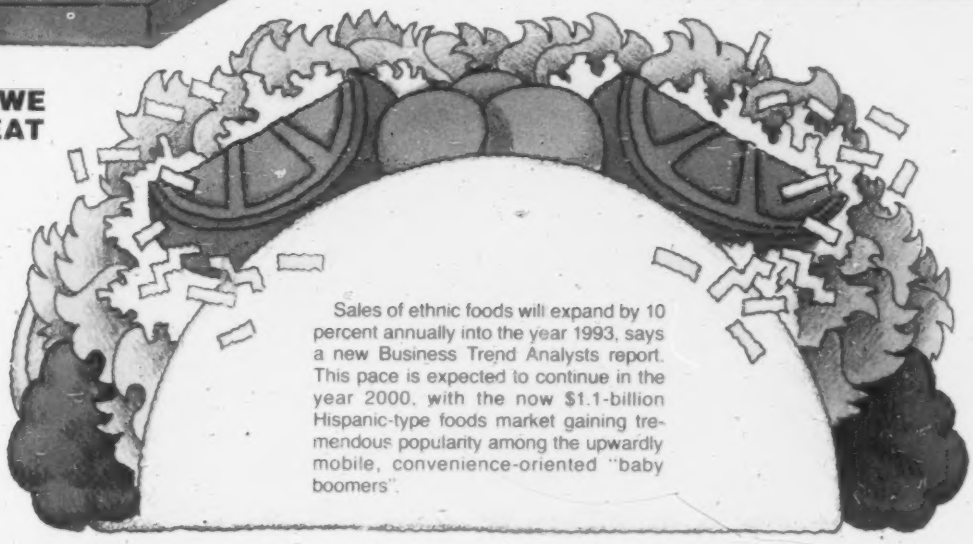


Industry onlookers agree that developing fresher processed foods with good nutritional benefits will be top priority fifteen years down the road. Forecasts show that caloric per capita daily intake—which now ranges between 3,300 and 3,400—will decline to 3,000 to 3,100 by 2000.

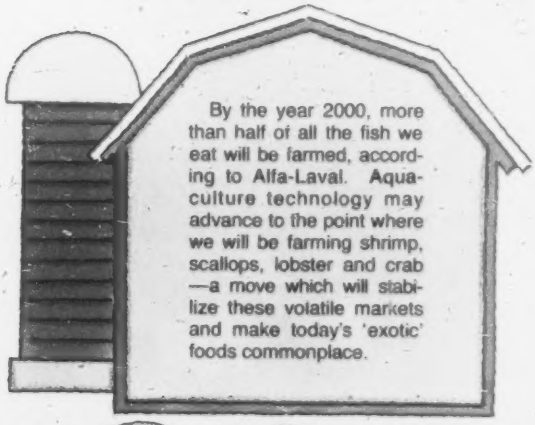


Cooking in a microwave will be the case rather than the exception, says Campbell Soup. Microwave ovens will be in 70-80 percent of all homes by 2000.

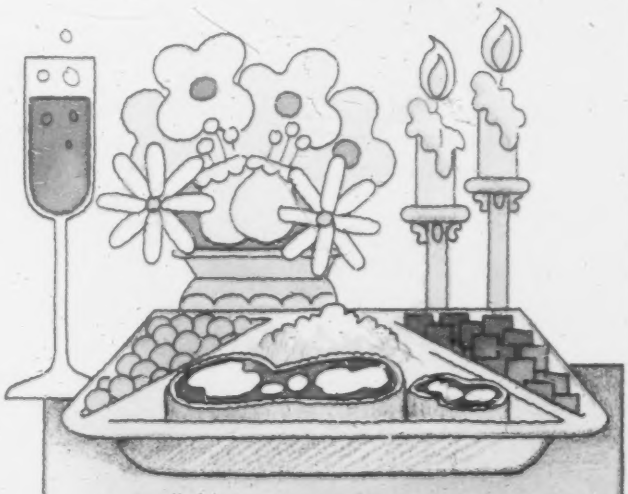
WHAT WE WILL EAT



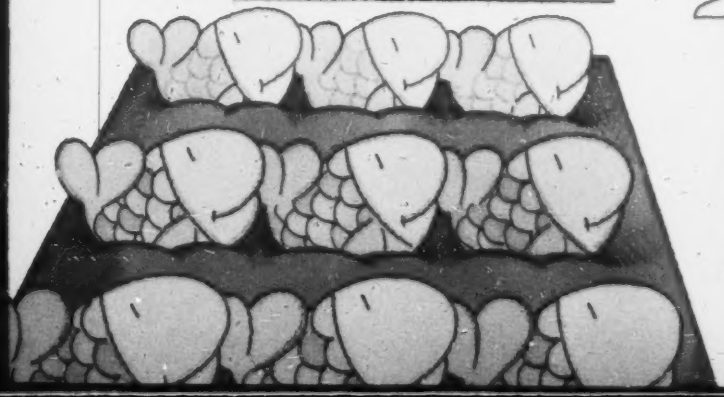
Sales of ethnic foods will expand by 10 percent annually into the year 1993, says a new Business Trend Analysts report. This pace is expected to continue in the year 2000, with the now $1.1-billion Hispanic-type foods market gaining tremendous popularity among the upwardly mobile, convenience-oriented "baby boomers".



By the year 2000, more than half of all the fish we eat will be farmed, according to Alfa-Laval. Aquaculture technology may advance to the point where we will be farming shrimp, scallops, lobster and crab —a move which will stabilize these volatile markets and make today's 'exotic' foods commonplace.



As the population grows older and disposable income increases, consumers will demand more sophisticated, convenient food dishes—many of them in the form of frozer entrees, agree industry sources. 'Premium' frozen food sales will quadruple by 1990, says a Find/SVP market survey, and are expected to continue their momentum into the year 2000.



FAMILIES BY INCOME: 1980-1995

	1980	1985	1990	1995
All Families	60,701.8	64,404.8	68,087.9	71,809.0
Less than $10,000	9,385.4	9,402.6	8,902.3	8,330.3
$10,000-$19,999	15,023.6	15,353.7	14,572.6	13,593.7
$20,000-$29,999	14,167.0	14,427.4	14,414.4	14,020.0
$30,000-$39,999	10,101.0	10,635.1	11,497.8	12,027.3
$40,000-$49,999	5,721.7	6,557.9	7,779.9	8,915.7
$50,000 and over	6,303.0	8,028.1	10,920.9	14,922.0

(FAMILIES IN THOUSANDS: INCOME IN CONSTANT 1982 DOLLARS)
SOURCES: DATA RESOURCES AND AMERICAN DEMOGRAPHICS MAGAZINE

Clearly, average income for family households will increase by 1995; and this trend is expected to continue into 2000. The number of families earning less than $30,000 annually will decrease, while the number of families earning $30,000 and over will increase. Families with incomes of $50,000 or more per year show the most significant increase.

maltier, calorie-laden import beers. Low-fat yogurts and low-calorie "ice-cream" co-exist in a market where Haagen-Dazs and other pricey ice creams, laden with butter fat, thrive. Another exception to the abstinence-trend is candy. Sales of some items, particularly premium chocolates, enjoy success in a land where calories are anathema. What all this adds up to, you might say, is confusion. But, in fact, what it does mean is that, in the American food industry, marketing is nearly everything. Those products running counter to the abstinence trend all sell the consumer something he'd like, usually image or the idea that you've saved all those calories drinking skim milk so why not splurge on some herbal, goat-milk cheese from France. America's food giants think treating food as a commodity is a sin. Anything can be dressed-up and sold for more. Quaker Oats, in 1985, will spend around $400 million on advertising and promotion. Campbell Soup Company will increase its promotion budget by a whopping 40 percent.

The important point to recognize is that this desire for both rich, calorie heavy foods and low-calorie, low-alcohol, "abstinence" foods is a creation of the baby-boomers. They'll carry this split personality with them right into the 21st Century.

The urge to merge

Can the food industry be owned by 50 corporations in the year 2000?

Figuring out what Americans will want to eat in the year 2000 could be the easiest challenge facing the food industry. For many, just holding onto their company will present plenty of mental exercise. The pace and significance of industry acquisitions and mergers hit a high-water market in 1984. In the twenty years from 1948 to 1968 a total of $5 billion was spent on acquisitions. But in just one year, 1984, that figure was smashed by just two buy-outs(Nestle/Carnation for $3 billion and Beatrice/Esmark for $2.6 billion.). There were 581 other acquisitions in 1984. The future strategies of America's major food manufacturers is clear: buy your way into new markets or distribution channels, then use plenty of marketing clout to increase market share.

Using some statistical projections, a USDA economist estimated a few years ago that 50 food corporations could own all the food manufacturing assets in the U.S. by the year 2000. Based on current rates of consolidation you can produce a statistical aberration like that. While more and more sales and assets will reside with a leading 50 or leading 100 food corporations by the year 2000, this doesn't mean everybody else is going to disappear. Actually there's plenty of room for entrepreneurial-type firms in the food industry. If they have a clear focus on their market and are well capitalized, they can do well.

New business formations in the United States increase at a rate of 500,000 new incorporations annually. A number of these will be in the food industry. In a recent speech, Frank Panyko of The Food Institute noted that while some sectors of the industry were losing companies there were gains in other areas. While the number of fruit and vegetable canners has been cut in half in 15 years, for example, over 50 new fruit and vegetable freezers launched businesses in the last ten years. In the baking industry, there are half as many bread and cake bakers today compared to fifteen years ago. But in another category--cookie makers--there are more today than in 1967.

As mentioned at the beginning of this article, two kinds of food firms will exist at the turn of this century. On the one hand will be large, multi-billion dollar conglomerates, perhaps account for 80 percent or more of food industry shipments and sales. Then there will be a kind of alternative food and beverage industry consisting of smaller, maybe regional, specialty firms with a unique product or marketing technique. The product line may not represent the volume a large company would need to compete. In other words, the way to compete in the food industry in 2000 will be to go where the food giants cannot afford to compete.

This ducking and weaving between the large food companies will not be without danger. To meet the changing consumer demands of the year 2000 companies must take certain risks. Increasingly the risk-taking will be done by smaller, idea-driven firms. One of their niches in the market will be to experiment with new ideas in technology, such as irradiation, supercritical extraction, controlled atmosphere packaging.

Some of these smaller companies may find a profitable niche by utilizing new marketing approaches. Some in the food business are

(Continued on page 98)

already experimenting with cable television, home computers, electronic fund transfer. "Teleshopping" and a variety of non-store marketing techniques will play a major role in the food marketing schemes of the future. For people who do not have the time to prepare food, it is only a matter of time before they decide they have little time to go to stores, wait in long lines, or put up with the other irritations of store shopping.

If a new production, marketing, or packaging idea fills a need in the quality and time conscious America of 2000, any company, any size, can prosper. These companies can operate on their own or wait for a larger corporation to drive up to their door with the money truck.

Here's an example of a small firm, filling a small niche, but then making it big. Tofu Time, Rahway, NJ, produces, as you can tell from the name, tofu products. In their first year of operation in 1983 they produced around $1 million in sales with no profit. In their second fiscal year, ending in 1985, they should produce just under $8 million in sales with a net income of just under $1 million.

Squeezing out profits

If acquisition is a central strategy, it will take higher-than-traditional profits to keep the company competitive

Acquisitions. Product development. Big marketing budgets. Running a major food corporation in the year 2000 will take money, more money than many food giants make today. Corporate advertising and promotion budgets for many large companies are already at a staggering 20 percent of sales. On the whole, however, the food industry is financially sound as a rock. Balance sheets are strong, in some cases produce a return on equity of around 20 percent and this, of course, is what has attracted so much acquisition attention. But despite a sound financial picture, profits could improve and that's where a lot of CEOs will focus their attention from now until 2000. Last year, for the industry as a whole, food processors turned in a respectable 8 percent gain. The goal now will be to push profit numbers into double digits.

Listen, for example, to Tylee Wilson, chairman and CEO of R.J. Reynolds, owner of Del Monte. "This is a pretty aggressive plan but we believe we can achieve it." The aggressive plan he refers to is pushing Del Monte's earnings to 2 1/2 times the rate of inflation, or just over 12 percent profitability. Del Monte will also aim for a 15 percent return on net operating assets after taxes before 1990.

But while the food industry is today perhaps in its strongest period ever financially, some food companies are going to spend the remaining years of this century trying to manage and pay for huge acquisitions. Not often discussed during the clamor over these acquisitions is that acquiring companies must divert management talent to bringing new companies into the fold. This and the highly competitive nature of the food business will place an even greater strain on profitability but increased profits will be the key to a strong industry in the year 2000.

New ways to make food

The critical role of research and development in America's food future

"Our vision of the company demands we bet on new technologies for the future," says James Ferguson, chairman and CEO of General Foods. Some of the frontiers Ferguson wants GF to explore include taste perception. He hopes GF researchers can find the secret to our taste mechanisms which "could give us a strong competitive advantage." He's also targeting biotechnology as a science to help the company develop new natural colors, flavors, and other additives. Health and nutrition will be the driving force behind research to "keep fats and cholesterol down without losing taste and texture benefits." Another area of concentration will likely be physical rather than chemical preservation systems.

While marketing and advertising have played a key role in the food industry's growth, it's a

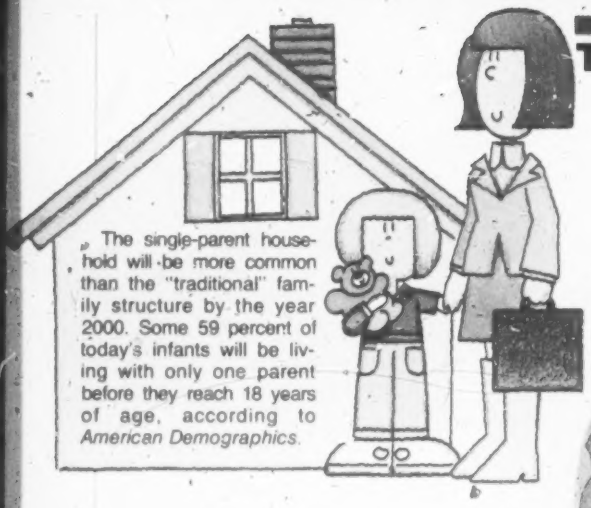
(Continued on page 100)

Overall demographic trends show the greatest population increase occurring in the 35- to 54-year-old segment by 2000; the greatest decrease will be in our 18- to 34-year-olds.

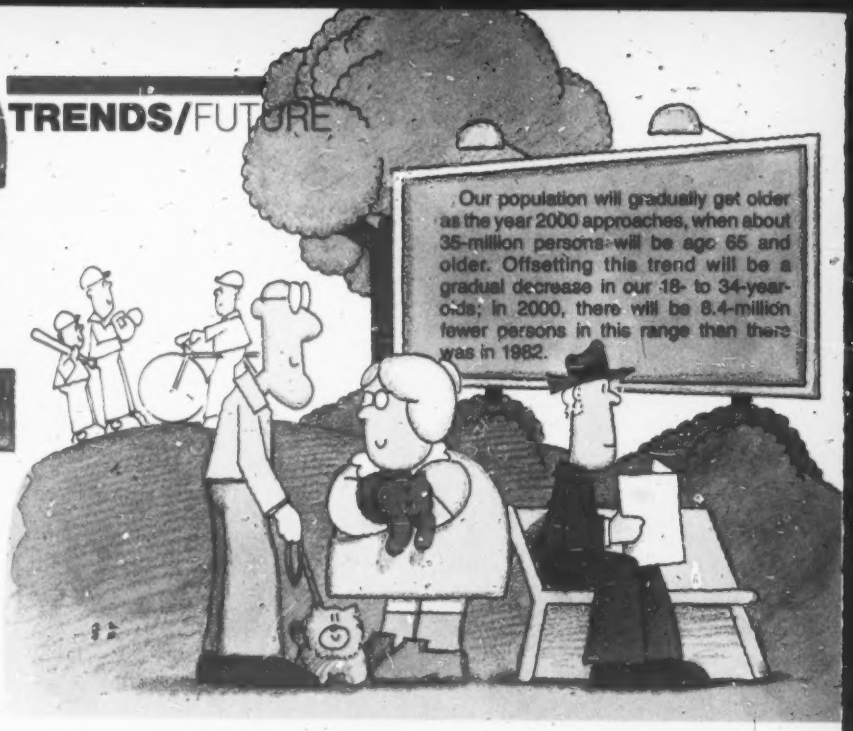
PROJECTED DEMOGRAPHIC TRENDS BY AGE

Demographic trends	1982	2000	2010	2030
Number of persons (in thousands and as percent of total)	231,964 (100.0)	266,496 (100.0)	281,732 (100.0)	307,340 (100.0)
Age				
18 to 24 years	29,804 (12.8)	24,882 (9.3)	28,629 (10.1)	28,771 (9.3)
25 to 34 years	39,416 (16.9)	35,783 (13.4)	37,605 (13.3)	38,715 (12.5)
35 to 54 years	51,570 (22.2)	79,177 (29.7)	77,160 (27.3)	77,651 (25.2)
55 years and over	48,334 (20.8)	56,270 (21.1)	69,184 (24.5)	88,100 (28.6)
55 to 64 years	22,141 (9.5)	23,824 (8.9)	33,760 (11.9)	32,236 (10.4)
65 to 74 years	15,756 (6.7)	17,283 (6.4)	19,586 (6.9)	31,561 (10.2)
75 years and over	10,435 (4.4)	15,162 (5.6)	15,837 (5.6)	24,302 (7.9)
Median age (in years)	30.7	35.5	36.6	38.0

SOURCES: BUREAU OF THE CENSUS, AND SOCIAL SECURITY ADMINISTRATION

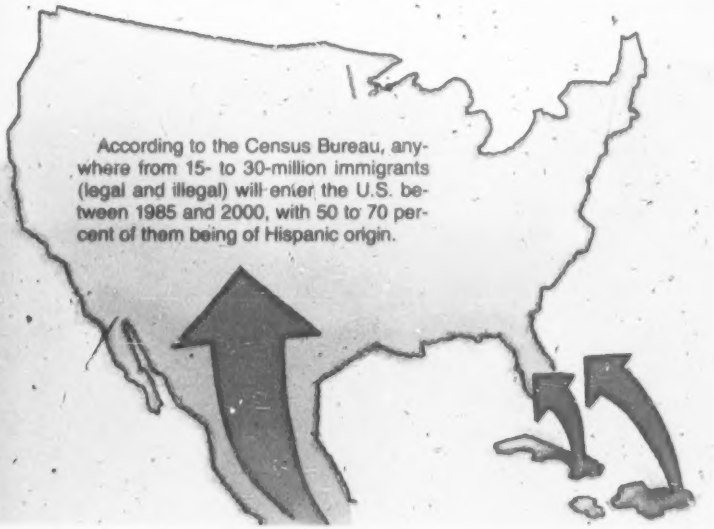


The single-parent household will be more common than the "traditional" family structure by the year 2000. Some 59 percent of today's infants will be living with only one parent before they reach 18 years of age, according to *American Demographics*.

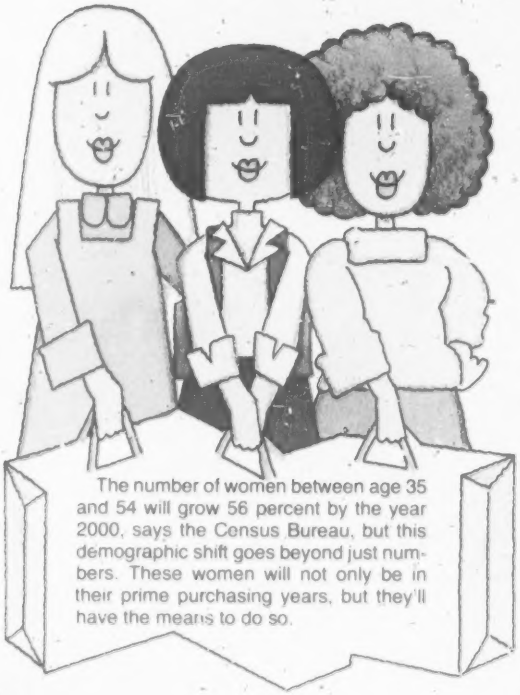


Our population will gradually get older as the year 2000 approaches, when about 35-million persons will be age 65 and older. Offsetting this trend will be a gradual decrease in our 18- to 34-year-olds; in 2000, there will be 8.4-million fewer persons in this range than there was in 1982.

THE WAY WE WILL LIVE



According to the Census Bureau, anywhere from 15- to 30-million immigrants (legal and illegal) will enter the U.S. between 1985 and 2000, with 50 to 70 percent of them being of Hispanic origin.



The number of women between age 35 and 54 will grow 56 percent by the year 2000, says the Census Bureau, but this demographic shift goes beyond just numbers. These women will not only be in their prime purchasing years, but they'll have the means to do so.

The year 2000 will "mark a millennium for marketers," according to *Fortune Magazine*, because the boomers will be in their prime spending years (40 to 59 years old). The seniors will include [illegible]

drain on profits and that could place a lot more emphasis on research at some firms. "We'll emphasize making foods in new ways, new products rather than just variations," says Eugene Sullivan, chairman and CEO of Borden. "We'll seek products with distinctive differences the consumer can observe without a lot of marketing and promotion."

One result of the emphasis on research will probably include increased attention to shelf stable processing and packaging systems. The reason: profitability. Perishables cost more--approximately five times the costs compared to shelf-stable products.

But the big question is who will do research in the future? To really make food in new ways, food companies will have to spend more time and money in fundamental or basic research and less on the so-called "black box" techniques of the past, according to Dr. Theodore P. Labuza of the University of Minnesota. "...the industry must turn away from the black-box techniques where X,Y,and Z ingredients are mixed together in a machine at settings A,B,C and you see if it turns out O.K. Product development, if it is to succeed in really making new or, improved products, will have to rely more and more on basic research," says Dr. Labuza.

Basic research costs money, lots of it. Will the food companies spend that kind of money on R&D? While some CEOs will direct their companies in that direction, a stronger potential exists that profit-driven food companies will put even more pressure on their suppliers for research work. In an increasing number of cases, the suppliers may become food manufacturers themselves. Back in 1975, for example, food manufacturing ranked last in R&D expenditures per dollar of sales and that pattern has not seriously improved in the last 10 years. Look, too, at patents applicable to food processing. Only 13 per cent of the 2,232 patents in this category from 1963 to 1977 were held by food companies. More than half originated with machinery, sanitation, packaging, instruments firms. One-quarter of the patents were owned by foreign companies and individuals.

In one respect the sheer size of the food industry--an estimated $300 billion in sales in 1985--guarantees suppliers will be willing to expend research monies in order to create business for themselves. CEOs Ferguson and Sullivan are right about the need to "make food in new ways". In the food industry of tomorrow gaining an edge in the marketplace will often be decided by a unique or uniquely improved product.

If the food companies do not carry their own research load, an opportunity will also exist for more independent food research firms.

"I just don't feel like cooking tonight"

Expect the hardworking baby-boomers to eat out more than any other generation

Male or female, married or unmarried, the above headline will become an even more familiar cry over the next 15 years. Eating away from home consumed 37 percent of the food dollars spent in 1981. By 1990, according to Graham T.T. Molitor, president of Public Policy Forecasting, this figure will have shot up to 50 percent. By the year 2000, a majority of our food dollars may be spent on food prepared away from home. In many American households that's true already.

Increasingly the foodservice market will become the principal market for many food processing companies. Foodservice operations will grow to depend more on food companies to supply packaged, convenient-to-prepare foods.

What could slow the foodservice juggernaut over the next 15 years, however, is the same tool that helped them become famous for fast preparation and service—the microwave oven. It is estimated that half the households in the United States now have a microwave oven and sales continue strong. That phenomenon alone has helped propel premium frozen dinners into the $400 million market range.

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Will "undernutrition" take hold?

Caloric per capita daily intake is on the decline. In the early 1900's, caloric per capita daily intake stood at 3,500 calories; now, it ranges between 3,300 and 3,400. And it's expected to decline to around 3,000 by the year 2000.

People are eating less, and will continue to do so. They may be consuming even smaller amounts than forecasts show, if the theory of "undernutrition" takes hold.

"The 90-year old man of the future will have the physical vigor of a 50-year-old man of today," said gerontologist Roy L. Walford in an interview with *The Futurist.* Walford and his colleagues at the University of California Medical Center in Los Angeles say they may have discovered the key to maximizing life spans, and minimizing the aging process. The key is undernutrition.

Undernutrition is actually a very low-calorie diet rich in vitamins and minerals, or in other words, "undernutrition without malnutrition." Experiments in the laboratory have proven successful. Mice with a life expectancy of about two years have lived beyond four years and maintained their youthfulness on the diet.

Why? Probably because eating less slightly lowers body temperature, says Walford, and lowered body temperature tends to increase lifespan.

Whether the theory will be proven successful in humans is yet to be seen. But industry and researchers do agree on this: Dietary restrictions—such as this and 'anti-cancer' diets—will become much more a part of the common consumer's everyday eating habits by the year 2000.

GAZING INTO THE FUTURE...

Flavoring foods: From an art to a science

Dr. Morley R. Kare
Director
Monell Chemical
Senses Center

The discovery of saccharin, aspartame, cyclamate and other food flavors were all accidents. By the 21st century, progress on the mechanism of the taste receptors will have progressed to the point where we will be able to predict sensory quality from the chemical structure of the stimulus. Flavoring in food will move from largely an art to more of a science.

We have passed through an era of heightened emphasis on toxicity in food and food additives. Food companies in the coming century will focus on the physiological benefits of the sensory quality of a food. Our knowledge of how a food influences ingestion, digestion and metabolism will be paramount. Foods will be designed with a view to how they relate to hunger, appetite, satiety and obesity.

The marketing department of food companies will include scientists. Genetic diversity of a population in terms of flavor perception and ethnic and environmental determinants of preference will be part of the data considered by these departments. Immunologic surveys will be used to project potential markets for a defined processed food.

At least some progress will have been made to understand how the brain processes sensory quality of food. This may lead to a search for how food affects human behavior and how mood influences preferences.

Heading toward a safer food supply

Dr. Theodore P. Labuza
University of Minnesota
Dept. of Food Science

The years between now and the turn of the century will be interesting for the food industry. It will be a time in which, because of acquisitions and combined R&D departments, the industry must turn away from the black box techniques of product development (where X, Y, Z ingredients are processed in a machine at settings A, B, C and you see if what comes out is good).

Product development, if it is to succeed in really making new or improved products, will have to rely more and more on basic research. For example, every snack food and cereal company wants a crisp texture in at least one of their products, but until we understand what causes crispiness at the molecular level it will be back to the black box technique.

Those that start to think in basics will be the leaders with the others being me-too producers. This basic research is not the panacea to all new products, however. Evaluation of consumers' views shows that the best is fresh; thus, I see several major changes by the year 2000.

More and more emphasis will be placed on control and extension of shelf life of fresh foods including meats, fish, fruits and vegetables. This will be through developments of new packaging that accurately control O_2, CO_2 and ethylene. Coupled with this is the potential for a synergistic effect of surface pasteurization with ionizing radiation. If industry can make the case to FDA that food waste will go down and quality will rise with no potential food safety problems, we will have a much greater choice of fresh products.

In addition, a trend toward hydroponics for very high quality fresh salad vegetables will increase. I envision these, however, only around major northern climate cities where industrial waste heat can be tied in to keep energy costs down.

Finally, the "freshness" desire till push supermarkets into the value added business to increase their profits in competition with the fast food chains. The trend will be towards selling ready to serve entrees from ethnic islands (Mexican, Italian, Chinese, etc.) in the supermarket. The foods themselves and the handling will have to take into consideration safety regulations. Thus these supermarkets will be a new outlet for the foodservice industry with products that can deliver both high quality and safety.

One problem will be education of the market personnel and consumers on how to properly handle the food to prevent food poisoning. Architectured foods will also be on the increase especially in fast food service where a reduction in quality may be

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overshadowed by the economics of reduction of labor, waste economies, energy and preparation time. Surimi and prefab egg logs are only the tip of the iceberg. As children grow to adults, this exposure to the engineered foods will make them less sensitive to the desire for really "fresh" products. They may not even want it. How many mothers prepare onion rings or french fries from scratch in the home? Thus, the year 2000 will present a greater dichotomy of consumer wishes which will only be satisfied by market segmentation.

One giant step for the flavor industry?

Skip Rosskam
Sr. Vice President,
Sales and Marketing
David Michael & Co. Inc.

The flavor industry and its interactive role within the full spectrum of the food and beverage industries will have made a quantum leap forward by the year 2000 *if* the food industry allows it.

Through continued progress in opening our doors to one another, we can foster an atmosphere that will encourage and accelerate the following changes:

- The flavor industry will be presenting new and improved flavor systems *in finished food products.*
- Flavor "samples" will no longer come in 60cc ambur bottles. They will be delivered in retort pouches, macro-waveable trays, brix packs.
- Our account managers will be MBA's, with a food science discipline. In essence, they will be marketing oriented, technical people with that innate self-motivation and desire to succeed, which is the very cornerstone of the professional sales person.
- We will be able to produce better natural flavors because of advances in instrumentation such as mass spectrometers, HPLC's and NMR's, enabling the creative flavorist to better isolate key constituents present in what Mother Nature produces.
- Computerization will allow flavor companies to catalog and reference raw materials, finished flavors and their applications faster, allowing better, more accurate service.
- As socio-economic conditions change and our world population increases, it is reasonable to assume that certain natural raw materials will become scarce, cost prohibitive or even non-existent. We must be able to predict and solve these problems by creating new and improved natural analogs and/or fully exploring the potential benefits that biotechnology offers us.

The future appears to provide many challenges for the flavor industry. Those who view the challenges as opportunities will be around to enjoy the year 2000 and beyond!

Making better use of today's technologies

Dr. Steven Young
Manager,
Product Applications
Archer-Daniels-Midland Co.
Research Division

Lest we forget, there are only 15 years which to consider. Although significant advances will be made in all areas of food technology, major change will come from implementation of the technologies of the 1980's. The industry will simply make better use of existing technology. The real revolution could occur in dairy and meat product formulation.

- *The Companies.* More emphasis will be placed on the use of existing ingredients, processing and packaging systems. As companies consolidate to take advantage of their individual strengths, new demands on ingredients, package and equipment supplies will be made. New technologies will be acquired and less will be developed "in-house."
- *The Ingredients.* There will be few truly new ingredients. Ingredient development will be expensive (remember, ingredient suppliers will be under the same pressures as their customers). Emphasis will be on ingredient use creativity. New application technologies will develop that allow product development without major ingredient modification. Many application concepts once held dear may no longer be valid.
- *Formulated Foods.* There will be a revolution in product formulation, primarily in the traditionally conservative dairy and meat industries. These industries are ready to explode with new product concepts. Old ideas will change as new foods will be dictated by ingredient availability, established processes and distribution systems, marketing requirements and nutritional guidelines. There should be more flexibility in product formulation which will allow quick response to changing market demands. The following will be major developments: Non-traditional foods, including foods of foreign origin; foods for special dietary needs; foods with specifically demanded

(Continued on page 109)

nutritional characteristics; and new products from old ideas.

Such developments should be mature by the year 2000, as meat and dairy processors allow themselves to be creative and to meet growing market demands. None of the above formulation opportunities should be difficult to adapt to advances in areas such as processing or packaging.

Evolutionary changes ahead

Dr. Dee Graham
Director,
Technology Development
Del Monte Corp.

There will be dramatic differences in food in the year 2000. But I believe most of the changes will be in the way food is packaged and delivered. The basic foods we eat—corn, peas, fresh fruit and the like—will remain a part of the American diet. But they could be presented in entirely new forms. Irradiation, the flexi-pouch and new generations of aseptic containers will make this possible.

The food industry has moved from selling the commodity, to selling the partially formulated product, to selling the wholly formulated product. As an example: First came flour, then cake mix, then ready-to-eat cakes. The next step will probably be improved ways of bringing the completed product to consumers.

Quality will be ever more important 15 years from now. This applies both to processed and fresh products. But as far as some of the 'blue-sky' ideas you hear about, I don't believe they will be that significant. The next decade should bring about evolutionary, rather than revolutionary changes.

Food plants become highly sophisticated

Bill Sander
Vice President,
Project Management
Hixson Architects/
Engineers

By the year 2000, there still will be as great a variety of food plants as there are food products—just as there are now. But, there will be significant developments in the more advanced and sophisticated facilities.

The trend setter facilities will be computerized, robotized and "smarter." *Product demands will require that the facility be part of the process rather than a shelter for the process.* The total internal environment of the plant will be pressurized and conditioned. Better trained people will be required to operate these highly automated facilities and the facility will operate more hours per year.

The higher production volumes and more productive hours will demand low maintenance, high durability materials and systems that can take punishment. The facilities will be designed for longer life. Life-cycle as opposed to first costs will rule the selection of materials and systems. Consequently, plants will cost more to build but less to operate and maintain.

The year 2000 facilities will serve a larger geographic area and be located outside of major metropolitan areas in small to medium size cities that "want" the plant to be there. These cities will offer the required support services and cultural amenities, a willing work force, financing assistance and tax incentives.

Continued economic pressure and a desire for a rapid return on investment will continue to maintain the desire to refurbish and recycle existing facilities—especially the utilization of vacant structures, in new market areas. The established infrastructure of an existing facility can provide a six to eight month compression of an overall construction project schedule.

Regardless of the type of product produced, the year 2000 plants will move that product in and out of the plant and into the distribution network more efficiently and effectively than today.

Future foods to focus on freshness

Dietrich Knorr
Daniel F. Farkas
Dept. of Food Science
and Human Nutrition
University of Delaware

New technology is adopted in a 5- to 15-year timeframe by the U.S. food processing industry. The following forecasts are based on currently identified developments.

Food preservation will focus on freshness with the objective of minimizing the effects of heat beyond that needed for proper preparation. Controlled and modified atmosphere packaging will be employed in combination with refrigeration, ionizing radiation and clean room techniques to achieve an extended shelf-life in processed foods.

It is clear that polymers in film, semi-rigid and rigid form will be the standard for all types of food packaging. Techniques for modifying the surface chemistry of plastic packages will obviate current problems of oxygen permeability and flavor scalping.

There will be a continued emphasis on selecting a prudent diet, that is, one high in

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complex carbohydrates and low in fat with modest amounts of animal protein. The chemistry of dietary fiber will have undergone a revolution similar to the developments in protein isolates and concentrates seen in the 1960's and 1970's. To this end extensive knowledge will be available on the effect of the chemical structure of a gum, hemicellulose or cellulose polymer on the nutritional value of the fiber isolate. This will lead to fiber isolates designed for specific nutritional affects such as cholesterol reduction and glucose absorption control.

Foods packaged in polymers will carry their own freshness indicators in the form of microchip sensors built into the package. Detectors will sense changes over storage time and indicate the quality status of the food.

The U.S. food processing industry will draw raw materials from outside the U.S. in even greater amounts. Feed stocks will be procured from primary overseas suppliers in semi-processed form as concentrates, bulk aseptic, irradiated and controlled atmosphere packs. High value flavors, colors and other function ingredients produced by tissue culture and fermentation will start to be available.

Convenience will be all-important

Herbert M. Baum
Vice President, Marketing
Campbell Soup Company

Foods will be minimally processed. Foods that have big chunk ingredients will be aseptically processed—retaining crisp, firm texture. Aroma encapsulation will be a major technology drive as aroma becomes more critical to food enjoyment. People will be eating more with their eyes (appearance) and noses (aroma), and sensory attributes will become more important.

Microwave ovens will be in 70-80 percent of the homes. Most convenience foods will come in plastic, table-ready disposable packages for no-pot cooking, with no clean-up. Cooking in a microwave will be the case rather than the exception; convenience will be all important.

Regular sit-down meals will become rarer. Hand-held, on-the-go, portable foods (single serving) will increase in importance.

By the year 2000, ingredients and packaging materials will be delivered more frequently allowing for "just-in-time" manufacturing; i.e. manufacturing to order — greatly reducing manufacturer and food store inventories (and associated carrying costs).

Fermentation technology takes charge

Dr. William L. Brown
President
ABC Research

Future food products will be developed to take advantage of fermentation technology. Two developments in recent years will be responsible for increased activity in using microorganisms in food processing. The energy shortage and cost of refrigeration make shelf-stable products attractive. The progress in biotechnology and our ability to transfer genetic material in microbes gives us the opportunity to produce new flavors, enzymes and stabilize compounds.

Microorganisms can be used as processing aids in bakeries, dairies and meat plants to produce traditional products and many new products.

Fermented snack foods made from a combination of bread, meat and cheese offer the unique advantage of good nutritional value and the convenience of eating "on the go." Finger foods also offer the opportunity to use microwave preparation and offer limited clean-up labor.

The development of flavors by fermentation has a solid foundation in oriental food products, i.e., soy sauce, miso, etc. A number of products are under development to produce fermented ethnic foods, with unique flavors.

Fermented vegetables fit in with our new lifestyle and a number of new products are being developed with vegetables.

Microorganisms will be added to food products to reduce the nitrite level in meat products and maintain safety against Clostridium botulinum. Lactic acid producing microbes will do this job and reduce nitrosamines at the same time.

The use of microorganisms to compete with pathogenic organisms will continue to be tested in the research laboratory and offers a means to control a number of the emerging pathogens, i.e., Campylobacter, Yersinia and Enteropathogenic E. Coli.

The future is indeed bright for the use of microorganisms in food processing and preservation.

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Nutritious, upscale foods more popular

Charles J. Carey
President,
National Food
Processors Assn.

• *Products.* Heightened consumer interest in the relationship between diet and health will make the development of nutritious, quality products the number one priority for food producers and processors. With an adequate supply of agricultural products and growing concern over obesity, the emphasis will be on quality and not quantity in food production and packaging. Advances in genetics and hydroponics will assure a consistent supply of the highest quality raw materials. Together with further developments in fish farming and the widespread use of global sourcing, a ready supply of food varieties formerly regarded as exotic will be assured. America's economic prosperity means that tomorrow's consumers will direct more attention and money to food, and that eating will continue to be seen as a pleasant, socially-desirable pastime. As a result, products will be colorful, featuring more tasty, high quality ingredients combined in new and creative ways.

• *Processing.* Traditional processes such as those employed in canning will be improved and used on a wider variety of products, and these thermally processed products will boast an ever higher nutrient count. Improvements to other processes, such as aseptic processing or irradiation, will allow greater use of these emerging technologies. For instance, aseptic packaging of products containing particulates is imminent, while anticipated regulatory approval of food irradiation will permit this technique to be used to sterilize packages or prolong the shelf life of some raw agricultural products.

Industry's most important changes ahead

James E. Hall
Group Vice President
Prepared Foods Group
Geo. A. Hormel & Co.

Computer technology in the year 2000 will provide food manufacturers the ability to develop regional or localized brands, to go after the segmented or niche marketing opportunities that will exist at the turn of the century. Just as self-service created mass marketing opportunities for national brands, in-store scanning and warehouse scanning will allow national manufacturers to direct their emphasis against an ever increasing consumer market segmentation. There will be no typical shopper, i.e. husband, wife, two kids and a dog.

Incomes will be greater as the increased earnings of an aging population come into play. Two income earners per family will be an American standard. There will be a need for smaller unitized servings to fulfill the needs of the ever increasing singles market, as well as an aging population.

The growth of Hispanics and other minority groups will increase demand for specialized products. Higher average income for all segments of the population will increase the expectation, in fact the insistence, of quality, superior to our current standards in processed foods. The packaging and the processing techniques will provide products nearer to "homemade" or closer to "fresh." It will necessitate the sourcing of raw materials and ingredients from wherever they are available, throughout the world, to fulfill the demand for unique and pleasant flavors—"A touch of Gourmet." Consumer expectations of quality will increase significantly as new packages and distribution systems are developed to deliver food in a "fresher" state.

The microwave oven will be as common to every home as a television set in the '80's. Prepackaged foods will be cooked in the microwave rather than just reheated. The quality and convenience of microwave cooking will become a way of life.

There will be continued emphasis on weight control, body toning, total physical fitness. Foods with specific nutritional values will be in ever increased demand. Elements in the food supply that "slow" the aging process will be popular. Examples are dairy foods high in calcium, foods fortified by vitamin E for tissue anti-oxident purposes, foods with anti-carcinogenic attributes such as broccoli, cabbage, etc. and meat with its anti-mutagenic factors. These theories, of course, still require further scientific substantiation.

Ethnic foods will be more and more popular. People want more natural foods, closer to what they prepare at home. Aseptic processing could well provide the quality consumers are going to demand from processed foods. Aseptic filling machines for particulates will have been proven successful and will be "state of the art." Irradiated foods will have the acceptance that microwaveable foods had in 1985.

High barrier rigid and flexible clear plastic containers will be making further inroads on glass and metal containers. There will be renewed interest in the shelf stable section as new ingredient, packaging and processing techniques are developed.

(Continued on page 117)

to significantly enhance product quality. This transition will be accelerated as energy costs for storage distribution increase substantially. Genetic engineering and technology will continue to grow, enabling us to develop new kinds of food through extended shelf life and through alternative processing techniques.

The years 1985 to 2000 will have witnessed far greater changes in packaging, processing and quality of food ingredients than all the previous years of the 20th Century.

Space-age packaging technology

James J. Fridl
General Manager, Marketing
Food Packaging Division
Continental Can Company

Though the segmentation efforts of marketers make it difficult to predict how food packaging will change in the next few weeks let alone by the year 2000, one thing is certain: Food packaging will be infinitely more varied and interesting than even the most visionary seers can imagine. To get a "sneak preview" at the ways in which packaging will change, we need only take a close look at today's consumer. Several fundamental factors regarding their lifestyles and needs can be expected to continue through the next decade and beyond.

Food growers will work with processors and packagers in a systematic approach towards developing products to fulfill consumer demand. Genetics and the growth in functional attribute crops will result in products ideally suited for particular processes and packages. The package itself will be more at home in the "kitchen of the future" with its microwaves, induction stoves and computer-coordinated convenience. Plastic, aseptic, microwaveable containers for food products including particulates will be commonplace in this kitchen, as will a greater variety of single-service packages. Consumers also will come to expect both refrigerated and non-refrigerated food packages to offer extended shelf life.

Other factors will make food packaging an even more vital concern from a global standpoint. Increased food demand will put additional pressure on our biological resources as regional needs will continue to outpace productive capabilities. Today's famines in Africa are related not only to agricultural failures, but also to the lack of adequate means of food storage and distribution. As genetics bring previously untillable acreage into production, the need for protective packaging systems will become even more crucial. These probably will be mobile systems placed close to the harvest, where they will aseptically preserve natural product qualities. They will likely produce large bulk storage packages for subsequent repackaging or distribution in aseptic form, fill and seal systems.

By the year 2000, man will be venturing into space to mine its mineral into energy resources. Satellite workstations will become permanent settlements with its unique food packaging requirements. This "test market" in space will dramatically demonstrate the importance of convenience and packaging in the food distribution cycle.

To come: Five major market changes

Dr. A. Elizabeth Sloan
Director, The Good Housekeeping Institute

While predicting how and what the consumer will want to eat in the year 2000 is difficult—if not impossible—I feel that there are five major trends that will strongly impact on the food industry in the year 2000 and that may continue to be major shaping forces of the industry for years to come.

First, the changes in the traditional family structure that have occurred in recent years will simultaneously create both a greater emphasis on the meal as a "centralizing factor" in family life, and a greater need for single-serving products. As family lifestyles become more harried, often with each family member on a different schedule, a meal occasion will become more important as the one time in the day when all family members come together. As a result, consumers will continue to want standard-sized packages with family-oriented portions. Simultaneously, however, family members will have a need for single or dual-serving packages for the times when their differing schedules simply do not allow them to sit down to a meal together. Parents will also want microwave products because they allow their children to make their own meals—safely—and it also gives them more time to spend with their families.

Second, the food market will continue to be *segmented* into separate groups with clearly defined needs. For example, the children of the recent baby boom will want soda, cookies, cold cereals, and other "kid-oriented" products; dieters will want

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packaged low-calorie meals and "lite" foods and drinks and people with medical problems will want foods specifically developed for their conditions.

Third, the major factor influencing food purchases will be a strong consumer interest in product freshness. Freshness will continue to appear at the top of the list of consumer concerns, even before price or nutrition. As a result, new technologies and new ingredients that will help food products imitate or achieve a fresher flavor, truer color, or more "natural" state will be widely used.

A fourth trend is that Americans will have become more accepting of new technologies as a result of their higher educational levels, greater exposure to technology in general, and more conservative outlooks. This is not to say that chemicals will be accepted again, but that technologies that replace additives—such as food irradiation, aseptic processing, and new types of packaging—will be accepted. Of course, rigorous sanitary, health, and disease-prevention standards will be imposed on all new technologies.

Finally, the interest in nutrition, healthful eating, and fitness will have become a permanent part of the American lifestyle. Consumers will continue to want products with a health or nutrition advantage, especially those that have reduced calories, sodium, or sugar. Nutrition information will appear on virtually all products, but it will take a new form, such as symbols or grades, rather than the complex numerical labels we see today.

Research function: Top priority

A.S. Clausi
Vice President,
General Foods Corp.
Director,
Technical Research

In my view, the research function in the food industry will assume ever-increasing importance during the remainder of the 20th Century and beyond.

Anyone who attends industry conferences and symposia—or reads the technical trade press, such as *Food Engineering*—cannot help but be impressed by the diversity and promise of new areas of attention. New techniques of packaging and preservation, and even entirely new food crops, have captured the imagination of the entire industry. These areas and others will give food scientists new tools to provide new products that consumers want. They can even help us to feed the world.

Developing and applying food technology will become more and more important—to compete effectively we must be able to move, and move quickly. Of course, competition is nothing new in the food industry. Now, however, the stakes are higher than ever before.

Research management will have a continuing responsibility to alert line management about technological opportunities—and also about the specter of obsolescence.

As an industry, we have a lot of catching up to do. Many of America's food production facilities are obsolete. Revitalization is a must, as in other sectors of the economy.

We in the U.S. have been preeminent in food technology. Will we fall behind? The research function will play a vital role in meeting that challenge as we enter the 21st Century.

2000 A.D.: A day in the life of a consumer

Laurel Aitler
Vice Chairman
Leber, Katz Partners
Advertising

She wakes up in the morning. Pressed for time, she drinks her breakfast in the form of a vitamin fortified yogurt fruit blend. She tosses an aseptic "VF" (vegetable/fruit juice blend) in her briefcase for a mid-morning pick-me-up. For lunch, she runs to the newest computerized vending machine, pushes a few buttons, and concocts her own "liquid salad" and a sparkling blend of berry and citrus juices (A little of this . . . a little of that!). She dashes off to her health club where she quenches her thirst with a personalized "activity drink" uniquely formulated for her individual needs. She meets her client for mid-afternoon conferences where flavored mineral water is served along with decaffeinated coffee. That evening, she joins her date for dinner. They "wet their appetite" with an aperitif. With dinner, she orders "lite" wine; he selects a low-alcohol beer. And in place of dessert, she orders Irish cream while he sips an Irish coffee. For a nightcap, she ends the evening with a cup of herbal tea.

2000 A.D. is today.

Some beverages are meals you drink. Juices sparkle. Soft drinks are softer. Foods are so soft you can drink them. Alcohol is blended with food (lite yogurt and ice cream). Coffee and tea are no longer addictive. Water is flavored. Energy drinks move

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from the health club to the office. More beverages become portable.

Today, alert marketers steal their way through barriers that traditionally defined categories. Old categories like coffee and milk are trending down. New categories are emerging. The action is in the niches between categories. New beverages:

- will be even better for you (replacing the vitamins and minerals that you need).
- will provide more pleasure—they will be irresistibly delicious and indulgent.
- will keep pace with you vis-a-vis packaging that's more convenient, more portable, that will warm or chill your drink which ever way you desire it.
- will help you keep the pace—serving as complete meal replacements that you can sip standing up . . . on the run.

Overall, the beverage industry's future is filled with opportunities. These are just some predictions. By keeping a constant and watchful eye on the environment, this volatile and dynamic industry will probably produce new products down the road that none of us has even dreamed of.

Seafood: Protein of the future?

Krys Holmes
Alaska Fisheries Development Foundation, Inc.

Protein will be the commodity of the future.

As farmland becomes more and more expensive to work, and as feed costs rise and the productive sector of the economy loses ground to the service sector, beef, poultry and pork proteins will become more expensive. Food processors will seek new sources of low-cost, efficient proteins; and they will have to look to the sea to find them.

Experts predict that seafood consumption will rise from 3.05 billion pounds this year to about 4 billion pounds in the year 2000. That figure doesn't include surimi-based blended seafoods, which have just come into their own in the last five years, and are expected by some to reach annual consumption levels of 1 billion pounds by 1990.

Seafood will ride the tide toward light, nutritious, digestible foods. As the population grows older and amasses more discretionary income, consumers will demand more upscale, sophisticated food dishes; and those premium seafood products like lobster, crab and scallops may be more popular. At the same time, seafood proteins will be available to the lower-middle class consumer in new forms.

In order to respond to the increasing desire for seafood protein, the seafood industry will have to provide a wider variety of products, all attractive to the public. It is known that consumers don't like fish because of its odor, bones and because they just don't know how to prepare it. Two-thirds of all Americans eat seafood only in restaurants.

A wider variety of convenient, attractive seafood products could court and win the heart of the turn-of-the-century consumer. If the U.S. seafood industry is not prepared to meet these needs in the year 2000, it is likely that the Japanese industry will be poised to seize the opportunity, as they did in our automobile and steel industries.

In the future, the attributes of seafood will be available in other forms and useable in other products.

Surimi technology, which is now just beginning in this country, will make available fish proteins and nutrients in literally hundreds of value-added products for the first time. Fish meat processed into surimi has a frozen shelf life of one year; unwashed mince deteriorates in 30-40 days. Surimi-processed fish can be used in a number of prepared dishes, as well as formed into blended seafoods and other products, and this will open up new opportunities for nutritious seafood.

Imagine fat-free surimi-based bacon bits on your salad. Imagine a protein-enriched Godiva chocolate or a no-carbohydrate whipped topping. Imagine a nutritious snack that your teenagers will reach for or a candy for children that's loaded with nutrients.

Surimi makes underutilized fish species available to food processors in ways more useful and more economically beneficial than ever before. Fish that have traditionally been considered "trash fish" could be processed into value-added products, bringing more profits to the producer and more protein to the consumer.

Surimi technology is now on its way to opening up other uses for sea proteins, such as in snacks, as fillers or binders, and even in products such as facial creams, cosmetics and pharmaceuticals.

In addition to developing new uses for fish and surimi in the American diet, food processors in the next 15 years may begin looking to other marine resources for nutrients to use.